Cardiothoracic Transplant Nursing: A Consensus Conference on the Current Nursing Practice in Heart and Lung Transplantation

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Abstract

Background

The role of nurses in cardiothoracic transplantation has evolved over the last 25 years. Transplant nurses work in a variety of roles in collaboration with multidisciplinary teams to manage complex pre- and post-transplantation. There is lack of clarity and consistency regarding required qualifications to practice transplant nursing, delineation of roles and adequate levels of staffing. A consensus conference was held to address these crucial issues.

Methods

Seventy-seven nurse participants (coordinators, practitioners, managers and researchers) with clinical experience in cardiothoracic transplantation, representing 4 continents attended the conference. Nursing preparation, roles, retention and model of care were presented followed by workgroup sessions. Modified nominal group technique was used to reach consensus.

Results

Consensus reached were; 1) a minimum of 2 years nursing experience is required for transplant coordinators, nurse managers, or advanced practice nurses; 2) a baccalaureate in nursing is the minimum education level required for a transplant coordinator; 3) transplant coordinator specific certification is recommended; 4) nurse practitioners, clinical nurse specialists and nurse managers should hold a master ’s degree; 5) Strategies to retain transplant nurses include engaging donor call teams, mentoring programs, flexible hours and career advancement support. Future research should focus on the relationships between staffing levels, nurse education and patient outcomes.

Conclusion

Delineation of roles and guidelines for education, certification, licensure and staffing levels of transplant nurses are needed to support all nurses working at the fullest extent of their education and licensure. This consensus conference provides such recommendations and draws attention to area for future research.

Introduction

The role of cardiothoracic transplant nursing has evolved with advances in research and clinical sophistication of heart and lung transplantation over the last 25 years. What began as a simple enlistment of resources, such as transplant nurse coordinators assisting in procurement, program organization and teaching patients, evolved into the addition of advanced practice nurses (nurse practitioners and clinical nurse specialist) working in collaboration with multidisciplinary team members managing complex patients. It is clear that this specialty has established itself as a transplant nursing mainstay. Success in terms of team performance and patient outcomes now hinges in part on a more formal explication of the roles and responsibilities of the various members of the transplant nursing team. In particular, the role of the transplant coordinator needs to be formally defined.

On April 12, 2011 in San Diego, California, USA, an unprecedented global transplant nursing conference was convened to formally engage in a dialogue related to crucial issues impacting cardiothoracic transplant nursing. The specific aims of the unprecedented Nursing Consensus Conference were to define minimal recommendations

for transplant nursing education, role responsibilities; and describe retention strategies and model of care. The 77 invited conference participants were nurse coordinators, nurse practitioners, nurse managers and nurse researchers, and represented 12 countries from 4 different continents (Australia, Austria, Belgium, Canada, Germany, Italy, Japan, New Zealand, Norway, Spain, United Kingdom and United States of America). A transplant cardiologist and cardiothoracic transplant surgeon, both vastly experienced in the field served as advisors to the conference. Representatives were chosen from small to large transplant centers as defined by the United Network of Organ Sharing (UNOS). The meeting included background presentations by experts in the field, followed by breakout workgroup sessions and finally a consensus discussion. Therefore, the purpose of this paper is to report findings of this event where participants sought to gain a global understanding of service structures and gain consensus for future directions of cardiothoracic transplant nursing in terms of governance, workforce planning and research.

Methodology

To reach consensus regarding recommendations for governance/structure, workforce and research imperatives, a modified nominal group technique[1] was used. Samples of 70 senior transplant nurses with greater than 5 years' experience were selected. Sample selection was representative of International Society for Heart and Lung Transplantation (ISHLT)-defined transplant center sizes, with small defined as 0-10/cases per year, medium 10 to 20 cases/year and large greater than 20 cases per year.[2]

Prior to the conference, experts were invited based upon their experience and expertise of cardiothoracic transplant nursing. Standardized questions were developed based on literature and common issues. Questions addressed focused on minimum core competencies, level of education, roles and responsibilities, recommended staffing levels, and areas of future research. Each breakout group considered the questions independently then responded aloud for documenting on a flip chart. Breakout group members discussed, ranked, and voted to identify the most important issues to take to the larger group discussion. The participants re-assembled and each group reported its discussion points. . Finally, the entire group voted to reach final consensus on the questions discussed in small groups.[3,4] Strengths of the nominal group technique include the expediency of reaching consensus due to preparation and having experts inform the issue for discussion. Additionally, the opinion of each member is collated for ranking by peers, resulting in the most relevant and important issues prevailing.

The following sections provide a summary of the presentations given at the conference and the key issues raised and discussed during the breakout workgroup sessions, followed by a summary of the consensus statements that were agreed.

Presentations

I. Education, Licensure & Certification: Setting Standards for Transplant Nursing – Connie White-Williams, PhD, RN, FAAN

In 2009, the American Nurses Association and International Transplant Nurses Society published statements regarding the scope of nursing practice in the field of transplantation[5] and defined nursing transplant nursing practice as:

"specialized nursing care focused on the protection, promotion, and optimization of the health and abilities of both the transplant recipient and the living donor across the life span. The depth and breadth in which individual registered nurses engage in the total scope of nursing practice is dependent upon education, experience, role, and the population served".

However, there are no consensus guidelines on required education, licensure, or certification for the specialty of transplant nursing.

- *Education*

Education among transplant nursing professionals varies depending on their country of origin (Table 1). Most staff nurses in direct patient care in the US who work in an intensive care or transplant step-down unit, or who work as a transplant coordinator, have a baccalaureate or associate degree in nursing; indeed, most hospitals are moving toward employing nurses with a baccalaureate degree to improve patient outcomes[6] to achieve Magnet status.[7] Similarly, the baccalaureate degree or its equivalent is required for entry

into practice for nurses in Europe, Asia, and Australia. Although Canada has licensed practical nurses, transplant coordinators hold baccalaureate degrees.

On the other hand, advanced practice nurses (APN) such as nurse practitioners or clinical nurse specialists have at least a master's level education. According to the North American Transplant Coordinators Organization (NATCO) and the International Transplant Nurses Society (ITNS), most nurses working in transplantation hold a baccalaureate degree (53.6% and 48% respectively). A smaller but significant percentage have a master's degree (21.7%) (American Nurses Association & International Transplant Nurses, 2009).

- *Licensure*

Licensure and transplant nursing practice is quite different across the world (Table 2). In the main, transplant coordinators are registered nurses. The scope of nursing practice in transplant nursing is governed by individual countries and states within those countries. For example, a transplant coordinator in England holds a Band 7 level of nursing and an advanced practice nurse may be called a nurse consultant but not have an advanced degree. In the US, the scope of practice may differ by state for a registered nurse practicing. For nurses with the job title of transplant coordinator, a usual prerequisite is 3 to 5 years' nursing experience and a baccalaureate degree, although a master's degree is preferred. In recent years, especially in the US, nurse practitioners have been incorporated into the traditionally non-APN transplant coordinator role.[8,9]

- *Certification*

In the US, national certification is currently not required for transplant nurses or coordinators. However, many transplant programs require transplant coordinators become certified within a year or two of employment. Use of the certification credentials attests to the transplant community and the public that the individual has met a standard of competency and possesses the necessary knowledge and skills needed to provide quality care for transplant donors and recipients The American Board of Transplant Coordinators (ABTC)[10] offers certification exams for transplant nurses, transplant coordinators, and procurement coordinators, but not for APN's. Approximately, 1100 transplant coordinators are transplant certified. However, many transplant nurses hold other certifications such as Certified Clinical Nurse Specialist (CCNS)[11-13] or Nurse Practitioner certifications (ACNP-BC).[14]

II. Blurred Boundaries: Defining Nursing Roles on the Transplant Team: A United States Perspective- Catherine Murks, PhD, APN

Within the structure of the cardiothoracic transplant team, the transplant coordinator, APN's e.g., nurse practitioner and clinical nurse specialist carry out multiple nursing roles to ensure safe care of patients, families and donors based upon their individual state-mandated scope of practice. Nurse practitioners are licensed to independently

evaluate, diagnose and manage patients in most states. Therefore, NPs commonly order and interpret diagnostic tests and prescribe medications including narcotics within the scope of their licensure [28.] Historically, CNS's have provided leadership, consultations and education to staff nurses with the goal of improving complex patient outcomes. However, recently, many states in the US have expanded the role of CNS to include treating and managing healthcare problems, including granting prescriptive authority[13].

In the US, transplant coordinators are usually educationally prepared as registered nurses with clinical experience and specialized training in an area related to transplantation. These nurses subsequently acquire organ-specific education and training in the coordinator role. Roles and responsibilities of transplant coordinators vary widely within the US depending on program and population needs. Blurred boundaries develop when the scope of practice granted by individual states is in conflict with the actual or expected tasks and roles of individual transplant team members. This can occur when baccalaureate-prepared organ transplant nurse coordinators perform roles typically requiring APN licensure such titration of immunosuppression. Depending on individual state practice, adjusting medication dosages may not be allowed even under the auspices of protocols guiding such adjustment.

Blurred boundaries are driven by multiple internal and external forces. For example a sense of power, autonomy, or job satisfaction can be gained by the transplant coordinator while exceeding the boundaries granted by licensure. Expectations of other team members or the institution may also drive individual transplant coordinators to take on

prescriptive autonomy when it is not appropriate. As clinical responsibilities for physicians increase, transplant coordinators may feel compelled to address urgent patient issues when physicians are not available. In a 2004 study of nephrology nurses, experienced non-APN nurses prescribed medications in response to abnormal laboratory values in the absence of the physician.[15]

Any nurse or transplant coordinator may feel protected by the physician or an established protocol; however, if a nurse is practicing outside of their scope of nursing practice, this is problematic. Whatever the cause, it is imperative that all nursing members of the transplant team be mindful of the practice governing nursing licensure in their individual state. As roles and responsibilities of nursing members of the transplant team develop, there must be appropriate support by legislation governing their practice. Individuals currently functioning in these roles must continually assess their actual practice and evaluate its congruence with existing regulations.

III. Challenges in Transplantation-International Perspectives: Situations Nurses Face in different European Countries - Christiane Kugler, PhD

Nursing in Europe is challenged by an increasing nursing shortage in the practice setting and the rationing of nursing care.[16-18] To date, literature describing the situation of transplant nurses is scant[19, 20], especially within European countries.[21] While recent standards for the scope of nursing practice in the field of transplantation have been

published in the US[5], no such standards exist to guide European transplant nurse professionals.

In preparation for this consensus conference, a pilot study was conducted to investigate nursing roles, responsibilities and blurred nursing practice boundaries in five European countries (Belgium, Germany, Italy, the Netherlands and United Kingdom). Ten cardiothoracic transplant nurses gave written consent to participate in semi-structured telephone interviews which lasted 23 minutes on average (range 20-44 mins). Participants averaged 9.25 years of transplant nursing experience (range 2-18 years); 7 were female and employed at academic transplant centers. Clinical job titles included clinical nurse specialist, transplant recipient coordinators, clinical nurses, nurse practitioners and advanced practice nurses with a majority holding a master's degree (n=6). The remaining nurses held a bachelor's degree or equivalent. Nurses from Belgium, Germany and Netherlands were responsible for inpatient and as well as outpatient clinical care services. In comparison, nurses from Italy and the United Kingdom worked exclusively in inpatient settings.

Nurse participants were asked about their practice responsibilities in relation to patient care nurse consultation, patient education across the continuum and research. One advanced practice nurse described herself as being "the spider in the net" as her role connected everything and everybody for the best interest of patients. Fifty percent of participants (n=5) reported they had taken on more responsibility due to changes in their roles and positions. Five nurses (50%) reported that their role crossed boundaries of their

scope of practice into medical practice. Nurses also reported having to take on responsibilities that could have been completed by other members of the transplant team (e.g. secretarial duties). All nurses participating in the interviews had observed changes with respect to their working conditions due to increased complexity of managing transplant patients, increased patient needs, managing more multiple comorbidities and increasingly older age cardiothoracic transplant patients. Nurses reported an increasing level of perceived exhaustion, burnout and stress.

Changes observed within the European transplant nursing community may be related to decreased hospital staffing, decreased days of hospital admissions and/or increased outpatient clinic visits. Indeed, the coordinating component of the role can be burdensome. Within Europe, transplant nurses roles seem to differ between countries and are associated with individual and system factors. To date, there is no European consensus on licensure or educational preparation for the different roles and responsibilities that transplant nurses perform. In this small study, it became clear that European transplant nurses are confronted with decisions that cross their nursing scope boundaries, increasing workloads and the need for ancillary support. All these concerns impact the recruitment and retention of an increasingly scarce nursing workforce.

IV. Recruitment & Retention Strategies for the Maintenance of Quality Nursing Staff -Kathleen L. Grady, PhD, APN, FAHA, FAAN

Recruitment and retention of cardiothoracic transplant coordinators and nurse practitioners is critical to the viability of transplant programs and quality outcomes of patients and families. Transplant coordinators are an integral part of transplant programs, and their presence on the transplant team is mandated by the US Centers for Medicare and Medicaid Services.[22] Cardiothoracic transplant coordinators have a specialized skill set. They manage the pre-transplant evaluation process, listing of candidates for transplant, and provide care to patients on the waiting list. They coordinate organ retrieval and peri-operative care and subsequently manage care of the transplant recipient in both the inpatient and outpatient settings. Patient and family education are also important parts of the role of cardiothoracic transplant coordinators. Additionally, in some centers, transplant coordinators provide staff education and participate in quality improvement and clinical research.

However, as nurses, cardiothoracic transplant coordinators may be faced with factors, similar to those identified by staff nurses that adversely affect recruitment and retention to the position. Nurses in hospitals are frequently dissatisfied with escalating patient volumes, staff shortages, high staff turnover, long work hours, increased interruptions and demands on their time, inadequate administrative support and inadequate remuneration.[6, 23] These 'dissatisfiers' have been shown to result in job dissatisfaction and burnout.[6] A summary of 94 observational studies of nurse staffing and relationship to outcomes by the U.S. Agency for Healthcare Research and Quality (AHRQ) demonstrated that hospital commitment to high quality care, combined with effective nurse retention strategies leads to better patient outcomes, patient satisfaction with

nursing care, and nurse satisfaction with the job and care provided.[22] Furthermore, AHRQ and European investigators have reported that nurse job satisfaction and autonomy were associated with a significant reduction in risk of patient death and that increased nurse-to-patient ratios and total nurse hours per patient per day were associated with improved patient outcomes, including decreased hospital mortality and decreased hospital length of stay; this was after adjusting for patient and provider characteristics.[22, 24] A retrospective analysis of data from nine European transplant centers also found that decreasing nurse-to-patient ratios were associated with greater inpatient mortality; specifically, an increase in a nurses' workload by just one patient increased the likelihood of an inpatient dying within 30 days of admission by 7%.[25] The importance of such findings cannot be overstated and should be heeded by transplantation team members.

Unfortunately, no research was found describing job dissatisfiers of cardiothoracic transplant coordinators or the relationship between nursing care provided by transplant coordinators and patient outcomes. Transplant nursing care models may impact patient outcomes including morbidity, mortality, quality of life, adherence to the transplant regimen, safe transition from pediatric to adult transplant care, and caregiver burden. Additionally, transplant nursing care models may influence resource utilization (i.e., hospital length of stay and rates of hospital readmission) and processes of care. For example, the safe transition from inpatient to outpatient settings where medication reconciliation, facilitation of clinic and other appointments, and provision of team contact information are critical to a successful transition. The unique and important contributions of cardiothoracic transplant coordinators to the care of heart and lung transplant

candidates, recipients, and their families compels our need to better understand how we can improve nurse recruitment and retention and thereby support transplant patient-centered care. With the current emphasis on positive outcomes, reduced cost and increased patient satisfaction, it also becomes apparent that attention to ensuring job satisfaction for transplant nursing professionals is necessary. Given the specialized role of transplant coordinators and the evidence regarding the influence of hospital nurse satisfaction and models of care on outcomes, the potential impact of cardiothoracic transplant coordinator nursing care on pre and post-transplant outcomes warrants investigation.

V. Staffing Benchmark: What is the Optimal Composition of a Transplant Program? – Linda Ohler, MSN, FAAN

There has been a growing interest in evaluating staffing levels of transplant programs. Most current data on transplant program staffing exists within the confines of general inpatient nurse-to-patient ratios.[26] Attempts have been made to measure the care required for patients' in ambulatory care, but most existing models are based on the inpatient measurement systems. Most tools to measure staffing in ambulatory care settings were developed prior to the diagnostic related groups (DRGs) and managed care, and were adapted from inpatient classification systems.[27] Transplant patient characteristics and needs differ in ambulatory care just as they do in the inpatient environment.

Patients and families awaiting transplantation with mechanical assist devices require more focused attention to technical and educational needs compared to patients and

families 2 years post-transplant. Patient acuity in the ambulatory setting will impact nurse ratios. Acuity levels differ between various organs systems and within pre and post-transplant patient status. But, how do we measure this? To date, there are no tools to measure the multifactorial variables of ambulatory care acuity or nurse patient ratios. Continued focus upon managing complex patient outcomes challenges us to also gain evidence to inform prudent staffing ratios to ensure the highest quality of care.

Two groups currently provide staffing benchmarks specific to transplantation: University HealthSystem Consortium (UHC) and the United Network for Organ Sharing (UNOS). Both conduct an annual transplant administrators' staffing survey and thus provide comparative data on clinical operations specific to staffing in transplant programs; however, extracting and interpreting data considered as valid can be problematic, although UHC data appears to be more financially founded. In this survey, definitions are provided for each practitioner and staff member. However, the actual function of each practitioner may vary considerably from center to center. For instance, a pre-transplant coordinator may have 25% of duties focused on-call, 50% pre-transplant evaluations and 25% in patient care. It is unclear whether these percentages reflect the non-US perspective, as there are no data published outside the US. In the future, a transplant-specific tool to accurately assess staffing ratios in ambulatory care clinics may be useful (see consensus statements).

Summary of background presentations

These presentations provided a comprehensive summary and useful background for discussion of the most pressing issues in cardiothoracic transplant nursing. These issues include the definition of nursing roles in the transplant setting, staffing levels required, education level required for each nursing role, and strategies to promote the retention of nurses and improve patient outcomes.

Models of Care at selected transplant centers

Staff of seven transplant centers then proceeded to present their structure for providing nursing care to cardiothoracic transplant patients: Tiffany Buda, Cleveland Clinic, Cleveland, Ohio USA; Ramona Spill, Deutsches Herzzentrum, Berlin, Germany; Angela Velleca, Cedars Sinai Medical Center, Los Angeles California, USA; Hwajoo Haynes, University of South Carolina, Charleston, South Carolina, USA; Bronwyn Levvey, Alfred Hospital, Melbourne Australia; Dora Rossi, Columbia University, New York, USA; and Celia Hyde, Papworth Hospital, United Kingdom. A summary of the models of care in each of the above hospitals is shown in Table 3. These models are useful practical examples of how care is currently organized at different centers across the world; however, the optimal model of care is yet to be determined.

Breakout Sessions

After the presentations and models of care presentations were presented, the participants were divided into four breakout sessions to allow for further discussion and interaction.

Each group included a mix of nurse coordinators, nurse practitioners, nurse managers and nurse researchers. Presentation topics were discussed similarly with the aim of reaching a set of recommendations applicable to all transplant programs, using the modified nominal group technique, as mentioned above. Several consensus points were reached. These consisted of recommended minimum levels of education and experience for thoracic transplant nurses, recommended staffing levels, recommended strategies for retention of thoracic transplant nurses and recommendations for future research.

Discussion of Key Topics during the Breakout and Convened Sessions

Minimal Specialty Experience and Education Recommendations

A minimum of 2 years general nursing experience is required for entry into the role of transplant coordinator, clinical nurse specialist or nurse practitioner. Prior critical care experience is preferred but not required. In terms of educational qualifications, it was generally agreed that baccalaureate in nursing was the minimum entry level required for the transplant coordinators role with a Master's in Nursing for APN role. Given the complexities of managing transplant patients, non-RN transplant coordinators were not appropriate for the transplant coordinator role. In addition, it was highly recommended that coordinators seek specialty certification. Currently, the Certified Clinical Transplant Coordinator (CCTC) qualification or international equivalent is the standard. In the future, the increasing complexities of these patients may require coordinators to obtain Master of Science nursing degrees. For nursing managers, a desirable combination of prior transplant experience and an advanced degree was highly recommended. Finally,

further study is needed to explore the appropriate nursing educational level and core competencies needed relative to scope of practice by state requirements for registered nurses and advance practice nurses caring for complex cardiothoracic patients. By consensus, these recommendations were felt to also be appropriate for international transplant nursing.

Recommendations regarding staffing roles and levels

Standard staffing recommendations were proposed; with staffing ratios of each role dependent on both inpatient and outpatient load (see Table 4). It was felt that a clearer standardized definition of the duties of transplant coordinator, nurse practitioner and clinical nurse specialist was needed, as these roles vary from center to center. In addition, the development of a transplant-specific tool to accurately assess staffing ratios in ambulatory care clinics was proposed. This would realistically measure time spent on each task required by specific staff members related to patient care, and hence, provide a more accurate view of workload for comparison between programs. The working group was committed to provide a standard against which staffing levels could be benchmarked.

Strategies to Improve Transplant Nursing Retention

Given the intensity of the training, expertise and workload of transplant nurses, proposals were made to improve their retention. In particular, the use of donor call teams to decrease call expectations for transplant coordinators was a common proposal. In addition, proposals were made with the aim of enriching transplant nurses professionally and intellectually. This might involve the establishment of mentoring programs for

transplant nurses, flexible hours (e.g. four 10-hour days) to support work and life balance, support for tuition to achieve advanced nursing degrees, encouraging nurses to participate in research and the existence of supportive leadership (both nurse and physician) open to suggestions to improve processes that have an impact role performance of transplant coordinator/nurses; and may benefit retention of stilled transplant professionals..

Future Research and Education:

It was agreed that more research is needed in the evolving field of transplant nursing. Studies investigating the impact of transplant nurse staffing ratio, level of education and qualifications on patient outcomes (e.g., survival, adverse events, and re-hospitalization) were proposed. Additionally, it was felt that the impact of an advanced degree on nurse satisfaction, patient self-management and adherence, and post-operative cost, needs to be investigated. To this end, it was agreed that hospital and academic partnerships should be established in nursing research, education, and clinical practice, with the aim of improving patient outcomes and reducing resource utilization. With regards to future certifications, it was strongly felt that the ISHLT should develop and administer a transplant nursing certification that would be applicable both nationally and internationally. Such certification could center upon nursing management of heart transplantation, heart failure, ventricular assist device, and lung transplantation patients.

Consensus Conference Recommendations

Concerning education, all transplant coordinators should possess a minimum of 2 years' nursing experience as well as a baccalaureate nursing degree. A master's nursing degree

is required for transplant nurse managers, nurse practitioners and clinical nurse specialists. Transplant coordinators should possess clinical certification. Development of an international standard of certification for transplant coordinators is needed. Further recommendations include:

1. Staffing ratios, with regard to numbers and mix of roles, depend on inpatient/outpatient case loads. Recommended staffing levels are detailed in Table 4.
2. Clearer standardized delineation of the roles of transplant co-ordinator, nurse practitioner and clinical nurse specialist are recommended.
3. Further steps should be taken to retain transplant nursing staff, through separate donor call teams, mentorship, support for advanced degree attainment, engagement in research, flexible hours and adequate support from leadership and administration.
4. Further research is recommended to investigate the relationship between nursing ratios/education levels and nursing satisfaction with patient outcomes.
5. Tool development to evaluate acuity of patients in the ambulatory setting is needed to inform adequate nurse patient ratios.

Summary of Conference

Nurses from around the world, with clinical expertise, experience and insight into cardiothoracic transplant nursing gathered to participate in this consensus conference. Important topics pertinent to heart transplant nursing were discussed. It was decided that guidelines for education, certification and licensure for nurse coordinators and advance practice transplant nurses are needed to ensure all nurses work to the fullest extent of

their education and license. It is hoped that the consensus statements from this transplant nursing conference will serve as a platform from which global governance, delineation of responsibilities, research and other pertinent issues within the cardiothoracic transplant nursing community will emerge and be addressed.

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APPENDIX A. CONSENSUS CONFERENCE ATTENDEES

Sherrie Adams, RN, Vanderbilt; Nerea Arnaiz Puerta de Hierro University Hospital (Spain); Sharon Augustine, NP, University of Maryland; Sharon Beer, RN, MsC University Hospital (UK); Shirley Belleville, RN, BSN, University of Utah; Paula Blanco-Canosa, Unidad de Insuficiencia Cardiaca (Spain); Nancy Blumenthal, RN, University of Pennsylvania Medical Center; Tiffany Buda, RN, Cleveland Clinic Foundation; Caron Burch, RN, FNP, MSN, CCTC, University of California Los Angeles; Deb Carter, MS, CRNP, CCTC, Johns Hopkins Hospital; Margie Chartrand, RN, BSN, University of Nebraska; Susan Chernenko, RN, MN, NP, Toronto General Hospital; Bernice Coleman, PhD, ACNP, Cedars-Sinai Heart Institute; Belinda Conner RN, CCTC, University of Kentucky; Judy Currey, RN, PhD, Deakin University and The Alfred, Melbourne (Australia); Annette Dabbs, PhD, RN, University of Pittsburgh; John Dark, MD, Freeman Hospital (UK); Anne Davison, RN, Freeman Hospital (UK); Fabienne Dobbels, PhD, University of Leuven (Belgium); Joan Doody, MS, RN, ANP-BC, Tufts Medical Center; Barbara Elias, RN, The Methodist Hospital; Mary Francois, RN, MS, CCTC, University of Wisconsin; Anne Fukano, RN, BSN, MBA, University of California San Francisco; Helen C. Gibbs, RN, Greenlane Clinical Centre (New Zealand); Kathy Grady, PhD, Northwestern Memorial; Kimmarie Hammond, ANP-C, Mount Sinai Medical Center; Christine Hartley, RN, MS, Stanford University; Hwajoo Haynes, RN, Medical University of South Carolina; Yumiko Hori, RN, National Cardiovascular Center (Japan); Celia Hyde, RN, Papworth Hospital (UK); Nichol Jones,

RN, MSN, CNS, Seton Heart & Specialty Transplant Center; Annemarie Kaan, MCN, RN, St. Paul's Hospital (Canaada); Patricia Kaiser, RN, CNS, CCTC, University of Texas Southwestern; Diane Kasper, RN, CCTC, Mayo Clinic; Peggy Kearney-Hoffman, RN, BSN, CCTC, Sutter Medical Center; Sally Keck, RN, Massachusetts General Hospital; Karin Keller, MS, RN, CS-FNP, University of Colorado; Jon Kobashigawa, MD, Cedars-Sinai Heart Institute; Stella Kozuszko, RN, BScN, Toronto General Hospital; Christiane Kugler, PhD, Hannover Medical School (Germany); Bronwyn Levvey, RN, Grad Dip Clin Ep The Alfred Hospital Melbourne (Australia); Patricia Manning, BS, RN, Integris Baptist Medical Center; Vicki McCalmont, NP, Sharp Memorial; Bridgette McDevitt BA, RN, CCRN, Washington Hospital Center; Katie McMahon, RN, BSN, University of North; Tara Miller, FNP-BC, MSN, Duke University Medical Center; Susan Moore, RN, MHA, University of Washington; Margaret Moses, MSN,FNP-BC Intermountain Medical Center; Sue Mullarkey, RN, University of Arizona; Cathy Murks, PhD, APN-NP, University of Chicago Medicine; Rhonda Newman, RN, CCRN, Medical City Dallas; Linda Ohler, MSN, VCU/Pauley Heart Center; Deborah Page, APRN- BC, Brigham & Women's Hospital; Debra Penk, RN, BSN, CCTC, Oregon Health & Science University; Michael Petty, RN, University of Minnesota Medical Center; Suzanne Reed, RN, CCTC, University of California San Diego; Eva Reich, Medical University of Vienna (Austria); Ann Marie Richardson, RN, BSN, CCTC, University of Michigan; Mikel Rodgers, RN, BSN, Drexel University; Federica Roncon, University of Padova Medical School (Italy); Dora Rossi, NP, Columbia University; Elaine Russell, RN, CTC, University of Kansas; Michelle Sarcol, RN, Kaiser Southern California; Felicia Schenkel, RN, University of Southern California; DeeAnne Seeger, RN, BSN, CCTC, Allegheny

General Hospital; Anne T. Shipp, Royal Children's Hospital (Australia); Kristin Simard, BScN, RN, University of Alberta; Lisa Smith, ARNP, University of Iowa; Gro Sørensen, RN, Rikshospitalet University Hospital (Norway); Ramona Spill, Deutsches Herzzentrum Berlin; Kathy St. Clair, MSN, APRN, BC, St. Lukes Hospital; Tatiana Valderrama, NP, Newark Beth Israel Medical; Angela Velleca, BSN, CCTC, Cedars-Sinai Heart Institute; Connie W. Williams, PhD, RN, University of Alabama at Birmingham; Heidi Wright, RN, North Cascade Cardiology

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	United States	Europe	Australia	Canada	Asia
Licensed Practical Nurse	**LPN**			**LPN**	
Associate Degree	**ADN**				
Baccalaureate	**BSN**	**BA / BSc**	**BSN**	**BSN** **BScN**	**BSN**
Master of Science	**MSN**	**MSc**	**MSN**	**MSN** **MScN**	**MAN**
Doctorate	**PhD** **DNP**	**PhD**	**PhD**	**PhD**	**PhD**
Abbreviations: **LPN:** Licensed Practical Nurse; **ADN:** Associate Degree in Nursing; **BSN** or **BScN:** Bachelor of Science in Nursing; **BA:** Bachelor of Arts; **BSc:** Bachelor of Science; **MSN** or **MScN:** Master of Science in Nursing; **MSc:** Master of Science; **MAN:** Master of Arts in Nursing; **PhD:** Doctor of Philosophy; **DNP:** Doctor of Nursing Practice.					

Table 1: Nursing degrees across the world.

	United States	Europe	Australia	Canada	Asia
Registered Nurse	**X**	**X Grades: Band 4 to Grade 8**	**X Division 1**	**X**	**X**
Nurse Practitioner	**X FNP, ANP, PNP, ACNP**	**X Band 4 to 8**	**X Master of Nursing Practice**	**X ACNP PHCNP RN (EC)**	**X**
Physician's Assistant	**X**	**X Slowly being introduced**	**X Slowly being introduced**	**X Slowly being introduced**	
Advanced Practice Nurse	**X APN**	**X Nurse Consultant/ APN**		**X RN (EC) CNS/NP**	**X APN,CNS Varies among countries**

Abbreviations: **FNP:** Family Nurse Practitioner; **ANP:** Adult Nurse Practitioner; **PNP:** Pediatric Nurse Practitioner; **ACNP:** Acute Care Nurse Practitioner; **PHCNP:** Primary Health Care Nurse Practitioner; **RN (EC):** Registered Nurse in the Extended Class; **APN:** Advanced Practice Nurse; **CNS:** Clinical Nurse Specialist

Table 2: Transplant Nursing Licensure Similarities and Differences across the World.

INSTITUTION	CNS RESPONSIBILITIES	NP RESPONSIBILITIES	PRE-TX COORDINATOR RESPONSIBILITIES	POST-TX COORDINATOR RESPONSIBILITIES	VAD COORDINATOR RESPONSIBILITIES	ADMINISTRATIVE ASSISTANT RESPONSIBILITIES
Cleveland Clinic	NA	▪ In-hospital coverage ▪ Discharge education ▪ Address any issues until first Post-transplant visit	▪ Pre-Transplant Referrals and Evaluations ▪ Patient Education and consent for transplant evaluation and transplant process ▪ Arrange Transplant Committee agenda/meeting ▪ Donor Call ▪ Procurement Coordination ▪ Waitlist Management	▪ Post Transplant Patient Management long term ▪ Post Transplant OPD	▪ Nurse Practitioner/ PA Inpatient care and management ▪ Nurse Practitioner/PA in LVAD OPD Clinic ▪ Communication from NP/PA to Transplant Coordinators ▪ On call for device related issues both inpatient and outpatient ▪ Consults for VAD Evaluation ▪ VAD Education/Study Consent/INTERMACS ▪ Arrange OR ▪ Device Equipment and Management ▪ Work with insurance companies	▪ Procedure/Appointment Scheduling ▪ Financial Authorizations (Insurance Verification) ▪ Secretarial support to Transplant coordinators, NP/PA, VAD team
Cedars-Sinai Heart Institute		▪ Rotate between inpatient transplant service and VAD service/VAD clinic ▪ Round with team, examine patients, write orders, dictate notes, teach house staff, discharge patients. ▪ See VAD clinic patients with VAD team	▪ Pre-Transplant referrals and evaluations: ▪ UNOS Listing, status changes, and waitlist management. TCR forms. ▪ Input and update all pre-transplant information in the hospital electronic transplant database ▪ All pre-transplant patient education ▪ Preparation for selection committee	**Inpatient Post-Transplant Coordinators:** ▪ Round with team ▪ Coordinate consults ▪ Patient/family post-transplant education ▪ Ensure entire team aware of plan of care ▪ Liaison to other departments ▪ Coordinate discharge and transition to outpatient program ▪ UNOS TRR forms **Outpatient Post-Transplant Coordinators:** ▪ Outpatient clinic 3 days per week: average 20-30 patients per clinic ▪ Prepare lab review 3 days per week with transplant physician ▪ Patient calls from lab review ▪ Office calls:		

				patients, departments, outside physicians ▪ Liaison for consults, test/procedure schedules ▪ Manage pharmacy refills ▪ UNOS Tiedi forms		
Deutsches Herzzentrum Berlin (Germany)		▪ In Germany the responsibility is with the physicians. They coordinate pre / post transplant patients and manage VAD recipients. ▪ We have a Transplant Coordinator, who manages all logistic aspects of TX. ▪ The nursing focuses on the care of patients during hospitalization and outpatient department				
Medical University of South Carolina		▪ Inpatient coverage (Post-Transplant Education) ▪ Outpatient transplant clinic ▪ VAD (BT & DT) coordination ▪ Heart failure/outreach clinics ▪ Pediatric inpatient coverage & outpatient clinic ▪ Review community labs/tests results ▪ Complete CTRD, PHTS, & INTERMACS forms ▪ Develop and revise teaching materials, protocols, & etc. ▪ Manage IRB requirements	▪ Pre-transplant and VAD evaluations ▪ Pre-transplant patient & family education ▪ Complete UNet Tiedi forms ▪ Manage Selection committee minutes		▪ Arrange device implantation & maintain equipment inventory ▪ Patient management - inpatient coverage & outpatient clinic ▪ Education: patient & family, EMS & ED staff ▪ INTERMACS management	▪ Appointment/procedure scheduling ▪ Taking phone calls ▪ Secretarial support to Transplant NPs/RNs

The Alfred Transplant Program (Australia)	▪ Pre & Post Transplant Patient Clinics (Heart or Lung) ▪ Patient phone call triage service ▪ Pre & Post transplant patient education ▪ Protocol development ▪ Part time transplant coordination/ administration / data management		▪ Pre-Transplant Assessment/Evaluations (Heart or Lung) ▪ Recipient Coordination (on-call service) ▪ Administration & data management		▪ In-patient & out-patient management post VAD insertion ▪ Patient & family education re VAD management ▪ Pre-Tx Assessment/ Evaluation ▪ Discharge planning	
Columbia University		▪ Participate Out Patient visit and management ▪ In-hospital coverage ▪ VAD coordination	▪ Pre-Transplant Evaluations ▪ Pre-Transplant Education ▪ Procurement Coordination ▪ Donor call	▪ Post Transplant Patient Management ▪ Patient Education (at discharge)	▪ Participate in inpatient/outpatient management ▪ Participate in research	▪ Procedure/Appointment Scheduling ▪ Financial Authorizations (Insurance Verification) ▪ Secretarial support to Tx coordinator or NP
Papworth Hospital (United Kingdom)		In our practice, the junior sister nurse is the transplant co-ordinator. Her roles include: • Co-ordinates transplant clinic • Assisting physicians with pre and post-transplant management of patients • Supervision of junior staff • Coordination of transplant retrieval process • reports to the matron/senior sister, who oversees the department	Transplant practitioner (Band 6) nurse acts as a mix of pre-/post-transplant and VAD co-ordinator: • Donor call/retrieval • Co-ordinates outpatient care • Co-ordinates Heart failure service • Assisting physicians with pre and post-transplant management of patients • Co-ordinates assessment potential of heart failure/VAD patients The Band 5 nurse assists the Band 6 nurse in all activities above, including organ procurement.			

Abbreviations: Tx: Transplant; CNS: Clinical Nurse Specialist; NP: Nurse Practitioner; VAD: Ventricular Assist Device; OPD: Outpatient Department; PA: Physician Assistant; LVAD: Left Ventricular Assist Device; INTERMACS: Interagency Registry for Mechanically Assisted Circulatory Support; UNOS: United Network for Organ Sharing; TCR: Transplant Candidate Registration; TRR: Transplant Recipient Registration; UNet/Tiedi: is the name of the UNOS database application into which data is entered; BT: Bridge to Transplant; DT:

Destination Therapy; CTRD: Cardiac Transplant Research Database; PHTS: Pediatric Heart Transplant Study; IRB: Institutional Review Board; EMS: Emergency Medical Services; ED: Emergency Department

Table 3: Models of Care at 7 heart transplant centers worldwide.

Number of Patients Evaluated	Optimal Numbers of RN per Patient Evaluated	Number of Heart Transplant In-Patients	Number of Tx Coordinators covering Heart In-Patients Heart Tx	Number of Post Heart Tx out-patients followed	Number of Post Heart Tx Coordinators following out-patients
1 to 10	**1**	**1 to 15**	**1**	**1 to 90**	**1**
11 to 20	**2**	**16 to 30**	**2**	**For every 90 out-patients add a nurse coordinator**	**For Every 90 out-patients add one nurse coordinator**
21+	**3**	**30+**	**3**		

*The participants suggested that for lung transplant programs the ratio should be one transplant coordinator to fifty-five (55) outpatients.

Abbreviations: Tx: Transplant.

Table 4: Consensus of Required Staffing for Heart Transplant Coordinators.